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Subcommittee on Personnel

COMMITTEE ON
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UNITED STATES SENATE

TO RECEIVE AN UPDATE ON RESEARCH, DIAGNOSIS, AND TREATMENT FOR TRAUMATIC BRAIN INJURY/CONCUSSION IN SERVICEMEMBERS

Wednesday, December 13, 2017

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U.S. Senate
Subcommittee on Personnel
Committee on Armed Services
Washington, D.C.

The committee met, pursuant to notice, at 10:09 a.m. in Room SR-222, Russell Senate Office Building, Hon. Thom Tillis, chairman of the subcommittee, presiding.

Committee Members Present: Senators Tillis [presiding], McCaskill, Gillibrand, and Warren.

OPENING STATEMENT OF HON. THOM TILLIS, U.S. SENATOR FROM NORTH CAROLINA

Senator Tillis: We will bring the committee to order.

And the witnesses on the first panel, please be seated.

Before I make an opening statement, I have to tell you that I am in my fifth day of what they call monocular vision. That is where my optometrist finally convinced me that I should try putting a contact lens in one eye, and then get my other eye to adjust to a distance. But right now, there is a fight between which eye is winning, so I had to get my staff to print the text a little bit larger, so I could make sure that I could go through the statement. But if you see me walking around in circles, you will know why.

[Laughter.]

Senator Tillis: But thanks, everyone, for being here. I especially want to welcome some folks who will be speaking from North Carolina.

Before we get started, the Personnel Subcommittee of the Senate Armed Services Committee meets this morning to receive testimony from government and civilian witnesses on traumatic brain injury, or TBI. TBI occurs along a continuum, ranging from mild TBI or a concussion to severe and penetrating brain injury. While treatment for TBI varies with the severity of the injury, management of mild TBI includes treatment of symptoms such as headaches, memory

problems, dizziness, and poor concentration, followed by slow return to normal activity.

From 2000 through the first half of 2017, the Department of Defense diagnosed over 370,000 servicemembers with TBI. Of that total number of diagnoses, over 305,000 were mild TBIs.

We know, however, that mild TBI is not a unique problem within the Department of Defense. It is a national problem. Last year, there were about 2.5 million emergency room visits related to concussions in the United States, and medical experts believe there were many more concussed individuals who did not seek medical care.

As a Nation, we must pursue multiple approaches to understand better the chronic effects of mild TBI, including the long-term neurodegenerative problems associated with multiple concussive injuries.

Today, we are fortunate to have a very distinguished group of witnesses joining us to discuss the diagnosis and treatment of mild TBI and to learn more about ongoing research on the effects of concussion on the brain.

On our first witness panel, we have Dr. David Dodick, professor of neurology, sports neurology, and concussion program director at Mayo Clinic; Steve Devick, CEO of King-Devick Technologies; and Dr. Chris Miles, medical director of athletics and associate director of sports medicine

fellowship, Wake Forest University School of Medicine.

And, Dr. Miles, I already warned you that I want to welcome you because I have great regard for the academic programs at Wake. I have no regard whatsoever for your football program.

[Laughter.]

Senator Tillis: With that stipulated, welcome to the to the committee.

Ranking Member Gillibrand?

STATEMENT OF HON. KIRSTEN E. GILLIBRAND, U.S. SENATOR FROM NEW YORK

Senator Gillibrand: Thank you so much, Mr. Chairman, for holding this hearing and for really shining a spotlight on something that is so important to both of us and to the entire military.

I join you in welcoming our witnesses today to discuss traumatic brain injury and the associated medical conditions. I am pleased that we have a variety of witnesses from different expertise inside and outside the government to discuss the current status of public and private advancements in diagnosis and treatment of TBI.

This is a very important topic not only for the military but for society at large. Every parent of a high school athlete worries about his or her son or daughter suffering a concussion, another word for mild TBI, and the long-term potential consequences of this injury. What we learn while studying TBI in the military may also apply to the treatment of their concussive injuries.

Certainly, we owe state-of-the-art care to our servicemembers who incur a traumatic brain injury as a result of their military duties. That is what this hearing is all about.

But it is more than that. Accurately diagnosing TBI is complicated by symptoms that overlap with post-traumatic

stress disorder, such as difficulty in concentrating, irritability or angry outbursts, and memory loss.

TBI and PTSD are commonly referred to as the signature wounds of war in our recent conflicts. Indeed, these are wounds of war, but there are other related wounds that also deserve more attention. We know that anxiety disorders, acute stress, sleep disorders, depression, substance use disorders, chronic pain, and other health conditions are also consequences of military service.

Reports indicate that there have been more than 370,000 servicemembers diagnosed with TBI from 2000 to 2017. At the same time, the Centers for Disease Control estimate that there are 2.8 million TBI-related emergency department visits, hospitalizations, and deaths a year.

The damage is not limited to the traumatic brain injury itself. Based on VA data, we know that veterans with a history of TBI are at higher risk for suicide, and other data shows an increase in diagnosis of dementia and Alzheimer's disease and chronic traumatic encephalopathy, commonly referred to as CTE, for those who have suffered a concussion and traumatic brain injury.

I am very concerned that servicemembers suffering from TBI, PTSD, and other service-connected conditions are too frequently disciplined and discharged with a bad-paper discharge for actions that are manifestations of these

injuries. Servicemembers suffering from moderate or severe TBI can incur a lifetime of physical, cognitive, emotional and behavioral challenges. These challenges can manifest as drug- and alcohol-related misconduct, aggressive actions, charges, assaults, AWOLs, and failures to follow orders.

These bad-paper discharges are too often a consequence of suffering from military-induced conditions and result in veterans not being eligible for care for these conditions from the VA.

Military leaders must do a better job in taking these medical conditions into account when servicemembers are merely exhibiting the symptoms of their service-related injuries.

Mr. Chairman, thank you for the hearing.

Senator Tillis: Thank you, Senator Gillibrand.

Gentlemen, each of you, we will just start from my left and go across, and you can spend up to maybe about 5 minutes on opening comments.

STATEMENT OF DAVID W. DODICK, M.D., SPORTS NEUROLOGY AND CONCUSSION PROGRAM DIRECTOR, MAYO CLINIC

Dr. Dodick: Mr. Chairman, Ranking Member, and distinguished members of the panel, it is, indeed, a privilege and honor to have this opportunity to appear before you today and provide testimony for this hearing on brain injuries in military servicemembers.

As was said, I am a professor of neurology and founder and director of the concussion program at the Mayo Clinic in Phoenix, Arizona. I have been involved in the evaluation and management of patients with concussion for over 21 years, and I currently oversee the clinical and research concussion programs at Mayo Clinic, several of which are funded by the Department of Defense and the National Institutes of Health.

I am the chair of the American Academy of Neurology's Concussion Committee, and I co-direct their annual Sports Concussion Conference. And I am also the president-elect to International Concussion Society and co-founder of Concussion.org.

So we will start with, what is a concussion? A concussion is often referred to as a head injury, but it is not synonymous with a head injury. It is, instead, an injury to the brain itself. This injury involves individual cells in the brain and the wiring that connects them. There

is both a primary and a secondary injury to the brain that results in dysfunction, disruption, and likely even death of living cells and their living connections.

The primary injury occurs from the direct impact of the blunt force or the rapid movement of the brain within the skull. But the secondary brain injury occurs because of an inflammatory response that occurs and the inability of stunned and sick cells to generate the energy required for their repair.

These primary and secondary injuries result in a breakdown of the normal electrical and chemical communication between cells, and it is this disruption of this extensive and interconnected communication grid that affects many sites in the brain and leads to the varied symptoms, several of which you already highlighted today, including physical, cognitive, emotional, and behavioral symptoms, that have an enormous impact on the individual, a very devastating one, and that actually affects the ability to function in daily life at work, at home, or in school.

So why is concussion a military and a public health priority? I think concussion by any measure is a health priority. It is very common, obviously. It can lead to permanent symptoms in some, and progressive neurological disease in others. And yet, as was alluded to, it remains significantly underdiagnosed.

For U.S. forces deployed in Afghanistan and Iraq in Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn, blast exposure was the leading cause of concussion. Blast injury results in the rapid transmission of an acoustic wave through the brain tissue.

Over the last 16 years, an estimated 320,000 U.S. troops, about one in five, returning from active theater has sustained a concussion. And among those, almost half experienced symptoms consistent with post-traumatic stress or post-concussion syndrome.

Therefore, not surprisingly, there is a heavy personal, family, and financial cost of these injuries to our men and women in uniform. The cost of care alone has increased from $21 million in 2003 to over $650 million in 2010, and the median health care costs for veterans with traumatic brain injury is four times higher than those for veterans who do not experience traumatic brain injury.

Among civilians, nearly 4 million concussions occur every year. And among these, sport-related concussion has obviously received the most media and public attention. While there are several reasons for this, chief among them, I think, is the devastating, long-term neurological consequences that have been demonstrated in amateur and professional athletes who participate in contact sport. And this should be of particular concern to all of us because

there are over 46 million children and adolescents in the United States who participate in sport, and they, in particular, are uniquely vulnerable to the complications of concussion because of the effects of brain injury on a developing brain that hasn't fully matured.

Another vulnerable population that is often not talked about is women. Approximately 20 million women experience a domestic violence-related traumatic brain injury in this country every year. A recent study by the New York State Office for the Prevention of Domestic Violence revealed that 92 percent of the women in domestic violence shelters were hit in the head by their partners more than once, and almost one in 10 were hit more than 20 times in the past year.

Concussion is underrecognized, as I said. And while the reported number of concussions in this country is staggering, the actual number is much higher. It is estimated that only one in six concussions, especially in sport-related concussions, are recognized and diagnosed. And this is due to a lot of different reasons, which I will get to.

One major reason for the lack of recognition of a concussive brain injury is the lack of symptoms. Just as brain injury from silent strokes and other silent lesions can occur in the brain, so too can silent concussions occur. And these so-called subconcussive hits have been

demonstrated to be far more frequent than actual concussions themselves, especially in contact sport athletes. These subconcussive injuries are especially important because the cumulative effect of subconcussive impacts results in a loss of the brain's normal architecture, and neurological and psychiatric consequences later in life.

Much of the research on subconcussive hits has been performed in athletes involved in contact sports. And if you look at many of these studies, some of which I have outlined in the testimony, you will see that even in individuals who have not experienced a concussion, there is a loss of normal brain function in those individuals, both at a youth level as well as at a collegiate and a professional level.

So these and other similar studies indicate that concussion is really the tip of the iceberg while subconcussive hits represent a larger, hidden danger that results in injury to the brain and lingering effects that are not being detected by current concussion assessment techniques.

While the majority of individuals, as was said, experience symptom resolution from a single concussion within a week or 2, post-concussion syndrome or the persistence of symptoms beyond 4 weeks occurs in about 10 percent to 20 percent of individuals after a single

concussion.

In children and adolescents, the percentage who experience persistent symptoms beyond 1 month has been shown to be at least 30 percent. Individuals who experience persistent symptoms may become functionally impaired or, indeed, permanently disabled.

In addition to post-concussion syndrome, repeated concussions and subconcussive hits can lead to permanent cognitive and psychiatric impairment, a syndrome known as traumatic encephalopathy syndrome. In individuals with traumatic encephalopathy syndrome, symptoms persist for longer than 2 years and progress over time.

The symptoms and signs of TES, or traumatic encephalopathy syndrome, are similar to those seen in chronic traumatic encephalopathy, or CTE. And as many of us know, CTE is a progressive degenerative brain disease that has been demonstrated to occur in individuals with a history of exposure to repeated head injuries.

Unfortunately, and this is something maybe we will get into, at this time, we do not yet know how to identify people who are at-risk of developing CTE, nor do we yet have a reliable method to diagnose the disease before death or to intervene with treatment that prevents or disrupts the progression of the disease.

I will end with the challenge that we as clinicians

taking care of these patients face. The diagnosis, I think, of concussion is challenging even for experts. The reasons for this are several.

First of all, many of the symptoms are subjective. They have to be reported by the athlete or the individual, and many times, they are not.

Or the symptoms, as I said, maybe absent. They may have had a subconcussive hit or a silent concussion or brain injury. A lot of times, the visible signs may not be present. Even for those of us who have been examining patients for over 20 years, the signs can be so subtle that they are not picked up on the routine bedside neurological examination.

And finally, the detection of concussion often requires objective and quantitative tests that are not part of the routine neurological examination.

Even when the diagnosis of concussion is made, the challenge of managing the patient is difficult because there are no pharmacological agents, not a single one, that has been shown to be effective in improving symptoms or interrupting that secondary injury cascade that occurs that I alluded to earlier.

Another challenge for the clinician is knowing when the brain injury has stabilized. It has been well-demonstrated now that the brain injury continues and is not fully

recovered long after the symptoms have resolved. So we are lulled into a sense of complacency, thinking that the examination is normal, the symptoms have resolved, and so that individual is ready to return to duty or ready to return to play, and that simply is not the case in many individuals.

And it is during this window of time where the brain is uniquely vulnerable to repeat injury that may result in symptoms that persist or, more seriously, may result in permanent injury.

So determining if and when this window of vulnerability is closed is very challenging without expensive brain imaging that is not widely available, not feasible on a large-scale basis, and still not validated as a reliable clinical tool that can be used on an individual basis.

So what is needed? Given the challenges in diagnosis, treatment, and the ability to provide patients with a prognosis, I think there is an urgent need for objective, widely available, and cost-effective tests that do the following: rapidly and accurately identifies when a concussion has occurred, allowing for the removal of that individual from the activities that place them at further risk; indicate when it is safe for an individual to return to their previous activities, and this will avoid exposing an individual to a repeat and potentially devastating

injury; predict who is most vulnerable to repeated concussions; and predict who is at-risk of long-term symptoms and chronic neurological impairment from repeated concussions and subconcussive impacts.

We also need tests that accurately diagnose traumatic encephalopathy syndrome and chronic traumatic encephalopathy so that treatments, when developed, and I am optimistic they are coming, can prevent the progression or at least ameliorate the symptoms of these diseases.

There is also, in addition to the diagnostic tests that are necessary, there is a serious need for treatments, treatments that can prevent these second injury cascades that are set in motion with that primary impact to the brain, because I think it is these second injury cascades that can persist for days, weeks, or longer that result in the progressive brain damage that occurs and likely results in the persistence of symptoms that these individuals experience.

I also think there is a need for treatments that facilitate the brain's ability to repair, adapt, and compensate for previous injury; to prevent the development of chronic neurodegenerative diseases; and to interfere with the progression of those diseases when they have already begun.

Until this occurs, I think we need to implement

validated examination techniques that are sensitive for the detection of concussion immediately.

I am confident of the dedication and commitment of the scientists and clinicians involved in this field, several of whom are in this room. And I am optimistic that the scientific and treatment advances will be realized for the benefit of millions of men, women, and children affected by concussion.

Mr. Chairman, Ranking Member, and distinguished members of the committee, thank you again for this opportunity and for your precious time and attention.

Senator Tillis: Thank you.

Dr. Devick?

STATEMENT OF STEVEN D. DEVICK, M.D., CHIEF EXECUTIVE OFFICER KING-DEVICK TECHNOLOGIES, INC.

Dr. Devick: Mr. Chairman, Ranking Member Gillibrand, and distinguished members of the committee, it is a high honor for me to appear before you today.

I am the CEO of King-Devick Technologies. We develop objective, physical, electronically transmittable tests of eyes and brain function, which are validated in peer-reviewed medical journals, and that are able to be administered by laypersons.

Before beginning, I would like to recognize Tregg Duerson, who is right there. Tregg is the son of NFL two-time Super Bowl winner Dave Duerson of the Chicago Bears and the New York Giants. Dave was a friend of mine. He was a brilliant scholar-athlete who graduated with honors from Notre Dame and later took his own life at 50 years old by shooting himself in the chest, so that his brain could be evaluated, because he was fairly certain he had chronic traumatic encephalopathy. He did, indeed, have an advanced case of CTE, although he was diagnosed with very few concussions in his career.

Tregg is a highly successful businessman now, and he is also a former Notre Dame athlete. His dad was drafted by a Montreal baseball franchise, too. Tregg has often said, if he played baseball, he probably would be still alive today.

But anyway, he has dedicated his life to doing something about CTE, which is a prevalent problem, called to attention again this week when the NFL had an issue with a diagnosis on the sidelines.

As far as our products are concerned, in a DOD- and NCAA-funded study published in November 2017 in a peer-reviewed journal, it is found that King-Devick tests were shown to have the highest test-retest reliability when compared with more than a dozen other concussion tests. This article was authored by members of the CARE Consortium, the NCAA, and the Department of Defense.

And in May of 2017, King-Devick Technologies was one of a group of participants ranging from Federal Government representatives, private industry, professional medical research and veteran communities invited to compete in the VA's annual Brain Trust InnoVAtion summit. King-Devick Technologies was selected as a winner of the 2017 InnoVAtion awards for its brain injury remediation and rehabilitation applications utilizing technology that allows for faster recovery from TBI and from concussions as well.

Because the diagnosis of MTBI concussions in servicemembers and everyone often relies on history alone, the DOD-VA clinical practice guidelines indicate that a confirmatory, objective test for concussions that could be used to direct support and/or predict outcomes would be

desirable. And in 2016, a group of military officers who were doctors identified the King-Devick test as a solution.

The quote from their article was, "We recommend the King-Devick test be utilized as a supplementary screening tool in those who have suffered a concussive event. Having preinjury King-Devick test data will allow more precise determination. Therefore, we recommend the test be included as a baseline for all warfighters prior to exposure to risk of MTBI. Having a validated, rapid, easy-to-assess brain-screening test can assist frontline providers in making return-to-duty decisions."

And since 2011, more than 110 peer-reviewed articles have been published in elite medical journals validating these King-Devick applications. These articles describe the products as clinical biomarkers, not serum biomarkers, and other aspects of the test helped in remove-from-play decisions. And the effectiveness of this detection led to its cobranding with the Mayo Clinic, the first cobranding agreement ever entered into throughout Mayo Clinic's 150-year history. The test, now known as the King-Devick test in association with Mayo Clinic, is the most validated sideline screening tool for concussions currently available.

Changes in performance can easily be transmitted to inform diagnostic and related clinical service provision and guide clinical decision-making from theater to medical

treatment facility.

Thank you.

Senator Tillis: Thank you.

Dr. Miles, I should say that my senior member from North Carolina probably has a decidedly different view of the Wake program, so you have some balance there in the delegation. You can provide your opening statement.

STATEMENT OF CHRISTOPHER M. MILES, M.D., ASSOCIATE DIRECTOR, SPORTS MEDICINE FELLOWSHIP, WAKE FOREST UNIVERSITY

Dr. Miles: Very good, sir. Chairman Tillis, Ranking Member Gillibrand, and honorable members of the committee, thank you for this opportunity to discuss concussion from an academic clinician's perspective.

I currently serve as the medical director of athletics and the head team physician for Wake Forest University, the associate director of the Primary Care Sports Medicine Fellowship at the School of Medicine, and the site principal investigator to the NCAA- and Department of Defense-sponsored CARE Consortium Research Study.

As a former college football player who has experienced concussion, I have seen all sides of this condition. Unlike many medical diagnoses, concussion is not yet well understood. This enigmatic condition not only has different presentations, causes, and outcomes for patients, but it also has very little evidence-based guided evaluation and management options, though research is changing this. Much of the management recommendations for sport-related concussion have been driven by consensus statements released over the last decade.

The most recent release of this came in 2017 as the result of the fifth International Consensus Conference on Concussion in Sport. Although the conference makes a

distinction between sport-related concussion and nonsport-related concussion, many of the key principles are shared between these two entities.

I have been fortunate to be part of several different research studies investigating the natural history of the condition, evaluation tools, and management options. The largest and most well-known of these is the NCAA and DOD CARE study. As part of the Grand Alliance, the CARE study is designed to answer scientific questions about the course and neurobiology of concussion in a definitive way. With 30 sites, including the four military academies, over 37,000 athletes and cadets have been enrolled, and over 2,500 concussive events have been captured and studied. This is nearly 100 times the number of subjects in the average concussion study.

Through this study, the NCAA and DOD Grand Alliance is setting the standard for concussion research and clinical care. The collaboration between universities and the military academies has provided data that is absolutely unprecedented.

Although it has been just over 3 years since its inception, this consortium has impacted the practice of concussion management in several ways. Perhaps most important to this committee is the finding that, historically, there have been some undue delays in the

return to duty of nonathlete cadets. This finding has changed management of concussion at the academies.

Unfortunately, the consortium is at a watershed moment. Funding for continuation of this highly important research has expired. An application for CARE 2.0, a study to further our knowledge, especially in areas of neurobiology and long-term outcomes, was declined by the Department of Defense.

The NCAA has agreed in principle to supporting the CARE 2.0 initiative, but funding from the DOD has not yet been secured. It is my hope that this committee sees the benefit in continuing this highly important work.

In addition to the work with the CARE study, our group at Wake Forest is involved in force sensor research through helmet and mouthpiece sensors, post-concussive biomarker data, and the role of genetics in post-concussion syndrome. We are also particularly active with the study of concussions in youth football.

Also being studied are blood and saliva tests to determine if we can predict which patient will have prolonged symptoms, and brain imaging techniques that may provide similar predictability information.

These types of studies are vitally important as, clinically, no two concussions are created equal. It is crucial that we develop an objective test that will help

diagnose and guide the management of this condition.

There are current tools, such as the King-Devick, but there is not yet a gold standard for concussion testing. If an imaging or a blood test similar to what we have for evaluating heart attacks were to be discovered, the evaluation and management could be standardized.

Perhaps of equal importance, if we were able to identify a gene that may predispose patients to the long-term sequelae of concussion, we could counsel those patients on avoiding potentially higher risk activities.

We are still too early in the study process of biomarkers, imaging, and gene identification to include them in clinical decision-making. More research funding will help to determine if these advances are, in fact, predictive and, if so, which ones do this the best.

I believe the importance of the collaboration between military and civilian clinicians and researchers in tackling the best way to diagnose and treat concussions is crucial.

Although the causes of injuries may be different, though certainly not always, the importance of being able to accurately diagnose and provide the best treatment is the same.

When a condition does not have an objective test that cannot be manipulated, there is always the risk that symptoms may be feigned. A student or soldier that wants to

avoid an activity could falsely report symptoms. A truly objective test will assist and guiding not only diagnosis of actual concussion injuries but will allow for a more rapid return to learning and activity in those who would not test positive.

Many entities have helped raise awareness of concussion to our society at large. We are likely more educated on the prevention and identification of concussion than ever before. Most athletes and military personnel recognize the importance of this topic for their safety and well-being.

However, there is still great work to be done. We must make activities safer and less of a burden on long-term health and the health care system. Researchers and clinicians must continue to grow the data needed to make evidence-based recommendations. And funding bodies must continue to make this topic a priority.

Thank you for your time, and I look forward to your questions.

Senator Tillis: Thank you all.

I have a question for Dr. Devick. Can you give me an idea of the cost, the timing of the tests, and where these tests can be administered?

Dr. Devick: Did you say the cost?

Senator Tillis: Yes.

Dr. Devick: The cost is less than $20 per year per

individual for unlimited testing. So there is very little cost involved.

Senator Tillis: And when is the test administered? After somebody has experienced an injury that you are testing for? Or is it something that you do on a recurring basis to a larger population?

Dr. Devick: The sideline application that we are partners with Mayo Clinic on is at the point of sidelines, immediately after the concussion occurs.

Senator Tillis: Is this a sort of test that could be reliably administered in a battlefield situation?

Dr. Devick: Yes. As a matter of fact, thousands of teams and leagues around the world use King-Devick tests, and they do it on a noisy -- the NFL doesn't use it yet, but I think they will get there. The Canadian Football League does. All of the administration can be done on the sidelines where there is noise and whatever else goes on, on the sidelines.

It is just a 2-minute test that checks your ability to move your eyes and --

Senator Tillis: What are the other alternative tests? Give me some idea. I would guess they would be competing against a test that has obviously gotten a lot of attention. But what does the landscape look like out there, in terms of options?

Dr. Devick: Right now, it is kind of a three-legged tool for sideline testing. One is oculomotor function, which is what our test applies to. And one is balance. And then one is cognition, like, "Who is the President? What day is it?" those kinds of questions.

I think that when you apply all three of those that can be done quickly on the sideline, you get very high specificity and sensitivity.

So as Dr. Miles said, ours is a tool. There are other tools that they should be combined with. But again, the whole suite of tools doesn't take long, and it can be done on the sidelines.

Senator Tillis: Is there any data out there with respect to false positives? I mean, is it highly accurate? Do we sweep in that may not have suffered an injury?

Dr. Devick: The false positives we aren't nearly as concerned about as false negatives.

Senator Tillis: Right.

Dr. Devick: So the specificity in the biggest meta-analysis ever done on our products, they combined 15 studies together, and the sensitivity was 86 percent, and the specificity was 90 percent, which is higher than anything like a Pap smear or anything else, and it is done on the sidelines.

No, it is not 100 percent, but it is certainly a better

indication than asking a player how he feels.

Senator Tillis: Okay.

And anyone who has information on it, what research has been done -- this actually speaks to something I will spend more time with the second panel, but Senator Blumenthal and I and others on the Veterans' Affairs Committee are worried about PTS and TBI that may have resulted in behavioral problems that ultimately precipitated an other-than-honorable discharge.

So what research has been done to the population who experiences a concussion or something on the spectrum of TBI where there are measured behavioral differences in the person after, that are virtually unrecoverable? They just become a part of who they are, in this case, a soldier.

Anyone who has any information on that, I would like to hear it.

Dr. Devick: The DARPA, DOD, VA study just done by Dr. Scher found with comorbidity -- that is what you described, where there is PTSD or something else in addition to a concussion. She found, in this article that is pending publication that Dr. Dodick may know more about than I, that when there is comorbidity, the defect under oculomotor test on King-Devick test --

Senator Tillis: Dr. Dodick or Dr. Miles?

Dr. Miles: So part of the CARE Consortium study is

looking at behavioral changes long term, both acutely and in the long-term setting. There is some speculation and I think some data to support that premorbid conditions, such as depression, anxiety, those sorts of things, may also play into some of the behavioral changes that occur post-concussively.

Senator Tillis: Dr. Dodick?

Dr. Dodick: Yes. I would say there actually has been quite a bit of work, especially imaging work, that has been done with some of these individuals. And so what they found, first of all, is actually the temporal lobe, which is sometimes referred to as the limbic lobe, where many of the structures in the brain are housed that govern and control emotional function, is altered. Its architecture is altered after a concussive brain injury. Such that I saw a recent study indicating that the amygdala, which is part of the brain that drives the fear response, part of the brain that is responsible for impulsivity, aggressive behavior, is actually enlarged after a concussive brain injury, while other areas in the temporal lobe, such as the hippocampus, for example, which is what allows us to remember what we are being told, actually shrinks over time.

Senator Tillis: So are you able to determine a change without having a reference point, let's say an image of the brain prior to the event?

Dr. Dodick: Very good question. So not exactly, but the studies that I am talking about compare to age- and sex-matched, or age- and gender-matched controls.

Obviously, it would be ideal to have a preinjury MRI scan on all these individuals, but it is not feasible or practical, so it ends up being compared. And it is within the 95 percent confidence interval of change in that individual.

So there are a variety of imaging studies. There are also some molecular studies that have been done showing an upregulation in something called the corticotropin receptor, which is a sensitive surrogate marker of stress response.

So there are physiological, biological, and imaging changes that occur in individuals who exhibit this impulsive-aggressive behavior after a traumatic brain injury.

Senator Tillis: Very good. Thank you all.

Ranking Member Gillibrand?

Senator Gillibrand: Thank you, Mr. Chairman.

While the symptoms of TBI may appear right away, others may not be noticed for days or months after injury or until the person resumes everyday activities. In some cases, servicemembers do not recognize or admit that they are having problems or understand the problem and how the symptoms they are experiencing impact their daily

activities.

Are you looking at delayed onset TBI in your research?

Dr. Miles: Absolutely. One of the nice pieces of the CARE study is the data points currently during symptom stage, in the asymptomatic stage, once they have returned and then again at the 6-month follow-up, the hope with CARE 2.0 is to continue that out for many years to see if there are potentially behavioral changes, mood changes, et cetera, that may occur.

And so that is part of the reason why the funding is so important, so that we can complete that part of the study.

Senator Gillibrand: And do you think it is getting enough research? And do you think there is any way we can integrate awareness of delayed onset into policies and procedures at the DOD and VA?

Dr. Miles: I think, just simply, as you mentioned, that it is out there, and we should be aware of it and educating not only physicians but commanders of units and those sorts of things that that is certainly something they should watch for.

Dr. Dodick: I alluded to the secondary injury cascades that are set in motion after the primary impact, and I think it is these inflammatory cascades that are set in motion that continue for days, weeks, or even months that are responsible for some of the delayed onset symptoms and signs

that you are talking about.

We and others are doing preclinical work in animal models showing what some of those changes are, because that allows us to sort of tee up high-value targets for therapy.

We are also doing some imaging work following patients prospectively over time to see some of the structural and functional changes in the brain that occur well after the injury.

Senator Gillibrand: Yes. I have seen those images. They are remarkable.

Dr. Dodick: They are startling.

Senator Gillibrand: They do some of it locally, I think at Walter Reed.

Dr. Dodick: Yes. So I think there really needs to be a public awareness campaign. We have seen the results of massive public awareness campaigns where individuals are educated about the signs and symptoms of stroke, for example, because now we have all these clot-busting therapies, and we need patients to recognize them and get into the hospital as quickly as possible.

We need the same sort of public awareness campaign around concussion. As I said, 20 million women have suffered traumatic brain injury. Forty-six million kids exposed are in contact sport.

It is a massive public health problem, and we need a

public awareness campaign that matches the importance of this problem.

Senator Gillibrand: I agree, which is why I think if we can have the military be state-of-the-art, we can then have a better conversation about sports and particularly kids in sports.

I mean, I do not want my child playing football. It would scare the heck out of me. Even soccer scares the heck out of me. I was glad when they finally said no headers until you are at least, I think, 13 or 14.

But these are real issues, and I think if the military figures it out, then the rest of us can figure it out. And that is why it is so important.

A second question. Based on your expertise and research into the diagnosis and treatment of TBI in the civilian population, what do you think the military and the VA can do to improve their approaches to prevention, diagnosis, and treatment? What ways can you guys influence the civilian world?

Dr. Dodick: I will start by just saying that I can only talk about what I can control in my own center, and in that control, we have implemented what we believe is an evidence-based objective and quantitative neurological assessment preseason -- I am talking about sport athletes now -- preseason and after injury.

And that is why I said earlier I think it is really important that we at least use the tools that we have. While not perfect, they are objective, they are quantitative, and they are sensitive for detecting concussion.

So I think an evidence-based approach needs to be implemented. And this field was evolving. Every day, new research comes out. And it is incumbent upon us, on behalf of our patients, to be able to adapt and evolve with the changing science.

Senator Gillibrand: And do you think that the military and VA approaches to diagnosis and treatment are effective methods for preventing the potential long-term consequences of injury?

Dr. Dodick: I am not intimately familiar with the military concussion protocol. But again, I would just say that, as science becomes available, I think that military physicians, civilian physicians, we all need to adapt and evolve with that.

Dr. Devick: I think that there are new things available all the time. One of the things is the oculomotor aspect that the military hasn't used much so far but is being used in branches of the military, and, of course, balance and cognition are being used.

So I think that package of three evaluating tools is

becoming more and more the state-of-the-art, at least in sports.

Senator Gillibrand: Thank you.

Dr. Dodick: It really needs to be objective and quantitative, because I have been examining patients for over 25 years, and even to this day, when an individual comes in with a concussive brain injury, I would have a hard time picking up, on a bedside neurological examination, deficits that I could hang my hat on and say, yes, this individual has a brain injury.

That is why I think the guesswork needs to be taken out of it. The subjectivity needs to be taken out of it. We have quantitative, objective tools. We need to implement them now. And we need to continue the research and work hard to find better tools.

Senator Gillibrand: Thank you.

Thank you, Mr. Chairman.

Senator Tillis: Senator Warren, before I recognize you, I want to thank you for your consistent participation in these subcommittee hearings. This is a very important one. I appreciate you being here.

Senator Warren: Thank you. And I apologize for running in. I am trying to cover another hearing at the same time.

Senator Tillis: I should also say there is a number of

hearings happening at the same time. This is a very important subject.

Senator Warren: But this is really important, and I really do appreciate your holding this hearing, Mr. Chairman. This is critical.

And I thank all of you for being here today.

Since 2000, more than 370,000 servicemembers have received a first-time diagnosis of traumatic brain injury. It is one of the most common and least understood injuries that servicemembers experience.

And thanks to the work that you and others have done, we now understand that exposure to blast pressure can result in an impact-related concussion where the brain is damaged because it bangs around inside the skull.

But we are also now coming to understand that the blast pressure wave can also cause harm by damaging the brain at the subcellular level. And while most people think of TBI as being the result of exposure to an IED explosion on the battlefield, we are now learning that it is not the only or even the most common source of blast exposure for servicemembers.

So I was very glad to get an amendment into this year's defense bill that requires the Pentagon to begin a longitudinal study of the blast exposure that our servicemembers experience on the battlefield and when firing

larger weapons during training.

Can I just ask you, Dr. Dodick, can you explain why tracking blast exposure over time is essential to helping us get a handle on this problem?

Dr. Dodick: I think a blast exposure traumatic brain injury is in some ways different than the kind of brain injury that one might experience on a football field or on an ice hockey rink. There is an acoustic wave, as I mentioned earlier, that travels through the brain at very high velocity that, at a microstructural level, damages the tissues and disrupts the connections between cells, in addition to, as you say, rattling the brain around inside its skull.

So there are multiple mechanisms of injury that I think are distinct and unique. And I know that there are some research labs in the country looking specifically at the cellular level, at the injury cascades that are set in motion after an acoustic blast like that.

So I do think the injury is different, and I think the work is ongoing right now to see whether or not, at the end of the day, does it really matter? Are the same cascades still set in motion? Is the initial impact injury from a blunt force to the head versus a blast injury, is that the same? And how different are they?

There is no question in my mind, as you allude to,

that-- up until recently, we have always said concussion is a functional brain injury from which 90 percent of individuals recover fully. That may not be the case, because even when you do an MRI scan, which is certainly more sophisticated and can see the brain at a finer detail than a CT scan, you may not see the injury until you peer at a microscopic level with special types of MRIs. And then you see these fiber tracks that are just completely disrupted, like you took a pair scissors to them, that you do not see on a routine MRI scan.

So I agree with you completely. There is a lot happening at a cellular level, at a microstructural level, that we cannot pick up on routine clinical imaging. We definitely need more imaging research, and we definitely need more basic research to understand whether or not these two injuries, the blunt force versus the acoustic blast, is similar in the damage to the brain that occurs as a result of them.

Senator Warren: That is very helpful, and it looks like we are going to get this one passed into law.

I also want to note that my amendment requires that the Pentagon consider the feasibility of a blast exposure log, analogous to a servicemember's jump log for airborne operations.

So let me ask about that one. Could data collection

like this help ensure that blast exposure is fully documented, so that servicemembers get appropriate care, if they later develop post-concussive symptoms?

Dr. Miles, could I ask you to weigh in on that?

Dr. Miles: Certainly. I think that the idea behind that helmet sensor and mouthpiece sensor data that we are researching to determine can we get a sense of how many blows and at what force those blows are occurring, that same technology could certainly be applied to our servicemembers.

Dr. Dodick had mentioned earlier the cumulative effect of subconcussive blows. And that same effect, whether that is because of blast injuries from using firearms or explosions in the field, although subconcussive at that time, when added up, can lead to these same symptoms.

And so I think the idea behind keeping track of the amount of force that the brain sees over a given time is a very good concept and may lead to a threshold identified that, when a servicemember reaches that, you pull them out of their activity or whatever they are doing that is leading to those exposures.

Senator Warren: Thank you, Dr. Miles. That is a powerfully important point. We all know that traumatic brain injury can have devastating, lifelong consequences for our servicemembers and our veterans, and I am grateful for the work you are doing in this area. I hope you will let us

know if there is more we can do.

I have a question about protective equipment, but I am already over my time.

Is that all right, Mr. Chairman? Is that all right?

Senator Tillis: That is fine.

Senator Warren: Thank you. Good.

So I want to go to another area here. The Pentagon is at the forefront of research into equipment that protects the lives of our soldiers and sailors and airmen and marines. For example, I am very proud of the cutting-edge research that the Army Natick Soldier Systems Center in Massachusetts is doing, everything from improving body armor to preventing stress injuries.

Natick is also at the cutting edge of helmet technology, and the research has shown that different helmet designs and shapes can change the way that blast pressure impacts the brain. But right now, most of the military helmets that we give to deploying soldiers are designed principally just to protect against bullets and other blunt injuries rather than blast injuries.

So Dr. Miles or Dr. Dodick, whoever would like to do this, what does the research tell us about the types of helmet modifications that might reduce pressure transmitted to the brain in a blast? Who would like to go?

Dr. Miles?

Dr. Miles: So I can speak to that in a hockey helmet and football helmet. I cannot speak to it in the military helmet. So if that is okay?

Senator Warren: Let me just ask, Dr. Dodick, would you like to speak to it in the military context?

Dr. Dodick: I do not know a lot about the actual helmet design that is being developed to prevent that acoustic wave or those pressure waves coming from a blast injury, so I am not familiar with that technology.

Senator Warren: But I take it what you would tell me, Dr. Miles, let's just do this one in a short summary, is that helmet design may have a powerful impact, and this is something you think might be worth studying in greater detail?

Dr. Miles: I think you said that very well. It may have an impact. There is a lot of discussion on whether or not football helmets are able to be designed to decrease concussive risk. Again, the injuries may not be the same, but it seems like a very important area of research for the military.

If that can be designed, and we can reduce the forces that the brain is seeing inside the skull, there is a great likelihood that you will --

Dr. Dodick: I would say, Senator Warren, that there is no evidence to date that any technology, helmet or

otherwise, has actually been able to reduce the incidence of concussion, because as you said very early on, it is that movement of the brain within the skull.

I make the analogy that it is like an egg. It is like a yolk inside of an egg. You shake it and you can break the yolk, but the egg looks fine.

Helmets have done a very good job at preventing skull fractures and preventing major, catastrophic intracranial bleeding, for example, but there is no evidence yet that they have been able to reduce the incidence of concussion.

Senator Warren: My view on this is that we owe it to our servicemembers, anyone who is put in harm's way, to have the best possible equipment and the best possible equipment starts with research to figure out what works and what doesn't work. So I hope this is an area where we are doing more in trying to determine what we can do to best protect those who are in the field fighting for us.

Thank you, Mr. Chairman. I appreciate, again, your having this hearing.

Senator Tillis: Thank you, Senator Warren.

And, Dr. Miles, I am not going to ask other questions except request that our office get together to talk about the consortium and see what we can do to try and help, because that really is a collaboration where it is not just DOD, it is private sector, everybody coming together. And I

think that holistic approach is probably going to produce the best result.

Thank you all for being here. We appreciate your time.

We can have just a brief transition. We will bring up the second panel and a brief introduction and get to opening statements.

Thank you all, and in the interest of time, I am going to go ahead and do a brief introduction and get right to the opening statements. I want to welcome the second panel: Captain and Dr. Michael Colston, director of military health policy and oversight for the Assistant Secretary of Defense for Health Affairs, Department of Defense; Dr. Joel Scholten, associate chief of staff for rehabilitation services for the Veterans Affairs Medical Center, Washington, D.C.; and David Cifu, senior TBI specialist and principal investigator, Chronic Effects of Neurotrauma Consortium, Department of Veteran Affairs.

Welcome all to the committee, and we will do a windshield wiper. We will start from the right and go to the left this time.

STATEMENT OF CAPTAIN MICHAEL J. COLSTON, M.D., U.S. NAVY, DIRECTOR, MILITARY HEALTH POLICY AND OVERSIGHT FOR THE ASSISTANT SECRETARY OF DEFENSE FOR HEALTH AFFAIRS

Captain Colston: Chairman Tillis, Ranking Member Gillibrand, members of the subcommittee, thank you for the opportunity to discuss the Department of Defense's efforts regarding traumatic brain injury.

I am honored to testify alongside my esteemed VA colleagues. And I would also like to thank you for your sustained leadership in support of our Nation's servicemembers, families, and veterans, especially those dealing with complex issues around TBI.

The department's approach to evaluation and treatment of TBI at the point of injury facilitates rapid identification and recovery, reducing the chance of another concussion before a servicemember has healed from a first. DOD's mandatory screening program promotes early identification of servicemembers with concussion, ensuring effective treatment of physical, cognitive, and emotional effects of the injury.

We know that after a brief period of rest, a concussed individual can begin a progressive return to activity. The vast majority of individuals who sustain a concussion improve clinically and do not have any sequelae. On the other hand, we see patients who continue to suffer.

In my practice as a psychiatrist, I have seen a number of TBI patients with comorbidities, such as adjustment disorders, pain, anxiety, depression, PTSD, and substance use disorders.

So in short, we find that TBI is a protean disorder that can present with a wide range of cognitive, behavioral, and physical deficits.

But we need to meet patients where they are on the road to recovery. So DOD remains focused on hard problems around diagnostic clarification, because we need to get return-to-duty determinations, administrative dispositions, and medical disability findings right.

DOD conducts state-of-the-science research as part of the National Research Action Plan, which coordinates our research priorities with VA and NIH. DOD also collaborates in the national effort to characterize degenerative conditions stemming from subconcussive events or blast exposures. The Army STARRS study is characterizing TBI's possible contribution to our suicide problem. And interaction between mental health and TBI research portfolios lets us know what we know so we can rehabilitate more servicemembers who present with complex symptoms.

As we look to the future of TBI research, we appreciate that the human brain represents the most complex organization of living structure in all of biology.

Our investments will pay returns. With your continued support, I am confident that our research discoveries, clinical innovations, and focus on readiness will bear fruit.

And I look forward to answering your questions.

[The prepared statement of Captain Colston follows:]

Senator Tillis: Thank you.

Dr. Cifu?

Dr. Cifu: I defer to my colleague, Dr. Scholten.

STATEMENT OF JOEL D. SCHOLTEN, M.D., ASSOCIATE CHIEF OF STAFF FOR REHABILITATION SERVICES FOR THE VETERANS AFFAIRS MEDICAL CENTER, WASHINGTON, D.C., ACCOMPANIED BY DAVID X. CIFU, M.D., PRINCIPAL INVESTIGATOR, CHRONIC EFFECTS OF NEUROTRAUMA CONSORTIUM, DEPARTMENT OF VETERAN AFFAIRS

Dr. Scholten: Good morning, Chairman Tillis, Ranking Member Gillibrand, and members of the subcommittee. Thank you for the opportunity to discuss traumatic brain injuries, or TBI.

I am accompanied today by Dr. David Cifu, my colleague who is the senior TBI specialist for VHA.

VA's TBI-polytrauma program delivers world-class rehabilitation services for veterans and servicemembers. Through this program, VA continues to advance the diagnosis, evaluation, and treatment of TBI.

TBI severity is determined at the time of injury and is based on the individual's ability to respond to the environment and to questioning. The majority of TBI is categorized as mild, which is usually more difficult to identify than severe TBI due to a lack of visible injury and unspecific symptoms.

In 2007, VA established a systemwide TBI screening and assessment program.

Senator Tillis: You may need to pull your mike a little bit closer. I think they are having a problem

recording.

Dr. Scholten: In 2007, VA established a systemwide TBI screening and assessment program. All post-9/11 veterans are screened when they access VA for health care. Those who screen positive are then evaluated by a TBI specialist.

Between 2007 and 2017, VA screened over 1.1 million veterans and diagnosed over 93,000 of these veterans with a history of a mild TBI. These veterans then received an individualized rehabilitation plan of care for their specific needs.

Individualized rehabilitation treatment plans are paramount to TBI care as these plans consider the impact of symptoms on the veteran's unique functional abilities and are developed with active input from the veteran and their caregiver to develop recovery goals.

Of the post-9/11 veterans with the TBI diagnosis, over 70 percent also have a PTSD diagnosis, and over 50 percent have both a PTSD and a pain diagnosis. This highlights the importance of active integration of mental health and pain care providers when treating individuals with TBI.

The complexity of care needed for veterans with TBI and polytrauma is best provided through an integrated medical system, such as VA's polytrauma system of care. This system includes over 100 facilities that provide specialized rehabilitation programs.

In the field of brain injuries, VA collaborates with multiple partners to advance care and research by working directly with our veteran service organizations, academic partners, the NFL, the NCAA, and Federal agencies such as DOD, NIH, and CDC.

VA and DOD have worked together to develop a common definition for TBI. In addition, VA has collaborated with DOD, NIH, and academic partners to develop and implement evidence-based clinical practice guidelines to help both standardize and enhance care.

VA continues to invest heavily in TBI-related research. In fiscal year 2017, VA spent over $35 million in TBI research on 164 projects, which includes four research centers and VA's annual $5 million contribution to the VA-DOD Chronic Effects of Neurotrauma Consortium, or CENC. The goal of this research consortium is to better understand the lifetime impacts of military service, particularly combat-associated concussions and their association with mental health disorders, dementia, and related neurodegeneration.

VA's research portfolio, coupled with its integrated TBI system of care, provides an optimal setting to better understand TBI and translate these findings to enhance clinical care.

Many veteran populations are recognized to be at higher risk for suicide, including those living with a history of

TBI. Because military and veteran suicide rates are elevated compared to civilian rates, VA has made suicide prevention a top priority. VA offers wide-ranging suicide prevention efforts to identify veterans at greatest risk. And in July 2017, VA changed its policy to allow urgent mental health treatment for veterans with an other-than-honorable discharge.

Mr. Chairman, thank you again for the opportunity to testify about the importance of TBI diagnosis, treatment, and research. We believe VA is a leader in each of these areas, delivering the best care available to our veterans. And we welcome the opportunity to advance collaboration with our Federal and private partners.

We also thank the subcommittee and Congress as a whole for their support in getting our veterans the care they have earned and deserve.

My colleagues and I would be pleased to answer your questions. Thank you.

[The prepared statement of Dr. Scholten follows:]

Senator Tillis: Dr. Cifu?

Dr. Cifu: I actually would be open to just answer any questions.

Senator Tillis: You are just here to provide all the answers?

Dr. Cifu: Yes, in the interest of time, sir.

Senator Tillis: Thank you all for being here.

I want to jump to something. Dr. Colston, we now are going to implement an electronic medical record in the VA that is a platform that has already been implemented in the DOD. So I am trying to think and I want to talk a little bit in two different buckets.

One is the concern that I have with people who have received -- and I am glad to hear from Dr. Scholten that we are helping with crisis intervention with persons with other-than-honorable discharge. I think that that is good.

But it seems to me that, on the one hand, looking forward, if we do a better job of whether it is their MOS, the role that they are playing when they are deployed where we know that they are going to be exposed to events that could potentially have this cumulative impact that Senator Warren pointed out, it would seem like we should really think through, maybe not in phase one of the EMR but in subsequent phases, how we capture some of these life events so that we can cumulatively look back and have a high degree

of certainty that this person may be suffering from TBI.

Does that make sense to you?

Captain Colston: Absolutely, sir, and I couldn't agree more. If I can relay a story, 30 years ago, I was a nuclear engineer on USS Carl Vinson. I wore a dosimeter, and every month in my medical record, the amount of radiation that I got was put in my medical record. That reactor on Carl Vinson could have killed me inside of a second, but between occupational protections that I had, medical protections that I had, we reduced the risk to zero.

Now, TBI is a much harder problem. The brain is a considerably more complex organism than just the body as a whole. Blast physics presents a number of challenges.

I know when Senator Warren spoke there, we are working on helmets. We are working on things to maybe get the blast wave to go around.

There are many separate things that happen when you get a blast or an impact, and it is really hard to document those things. It is a very hard thing to ascertain. So I think, for right now, it is very important to get good histories. And that is where our corpsmen and medics come in with our concussion evaluations that discuss what the circumstances were.

We also have an obligation as clinicians to get really good histories and document exposures. I am heartened that

the VA is going to have the same medical record as us, because I have worked in both systems, and I can say it has been very hard over the years to kind of figure out what is going on, or the delay has been inordinate.

So I am excited that that is where we are going forward.

Senator Tillis: And to any of the panelists, I think it was Dr. Dodick that said, even if you do not have a prior image, that it was about a 95 percent confidence interval in being able to look at a brain image and reasonably determine that they had suffered some sort of a concussive trauma.

Is that possibly something we should look at as a way to go back at some members who have been other-than-honorable discharge and say maybe there was something there that we did not take into account?

Dr. Scholten: I believe that the evidence may not be there to support that type of implementation at this time. I think the approach right now is to have a no-wrong-door approach for veterans or servicemembers with an other-than-honorable discharge.

With implementation of that policy for those individuals that can access for urgent mental health needs, during that time, that episode of care can last up to 90 days, during which time we can investigate the background, their clinical presentation, and determine possibly if their

benefit profile should be changed.

Dr. Cifu: In addition to that, as part of the Chronic Effects of Neurotrauma Consortium, the large VA-DOD study, we are looking at exactly this issue of dose effect from brain injury. And we have a validated measure to figure out, did they have prior concussions?

Actually, the biggest challenge we have is to find veterans and servicemembers who have not had a prior concussion in their records. That is the hardest challenge. But we have a validated metric.

So we are recording that, and it is published, and it is standardized. But we are recording that as well as monitoring serial MRI scans, eye-tracking scans, all the things the prior panel talked about.

What we are trying to do is actually get the knowledge so that, if we had that information, we could actually act on it. Because it is scary to know that you have had this dose effect, whether it is from radiation or from brain injuries. What is even more scary is if your clinicians have no clue what to do with it.

And so what we are trying to do is, instead of just thinking we know what to do with it, we are trying to really put some data around that so we are on top of it.

We hope next time we are able to report in front of you, we will be able to give you hard evidence on that.

Senator Tillis: Thank you.

Senator Gillibrand?

Senator Gillibrand: Thank you for being here.

What is the military doing overall to ensure that it will do a better job in assessing program effectiveness on more evidence-based practices, providing appropriate training to providers, and collaborating across the services? Because the October report from the Secretary of Defense evaluating specific tools, processes, and best practices to improve the Armed Forces identification, treatment, and mental health conditions in TBI identified six areas to improve service provision, including frequent use of evidence-based practices and better specialty certification for providers.

Captain Colston: I can speak to that, ma'am.

We just spent $50 million from CAPE to look at programs for effectiveness, and I think one of the things that we really struggled with was outcomes and fiscal granularity, as we looked back.

So going forward, that needs to be a part of the way that we do business. So we created a behavioral health data portal that, in essence, gets outcomes that are in the medical record and will be there for perpetuity.

We also need to make good choices with regard to programs. We need to have a stop-doing list. So if a

program is not effective, it needs to come off, because it is presenting an opportunity cost, and that is something that we definitely need to focus on going forward.

Senator Gillibrand: So I did not feel like you answered Senator Tillis' question fully in the last question, because he is really saying, what are you doing to create an opportunity for someone who may well have been discharged dishonorably because of behavior that is absolutely against the rules but that would have been caused by traumatic brain injury or PTSD?

So, specifically, can you address that? What are you doing to protect those servicemembers who may well have been punished for inappropriate behavior that was actually caused by these diseases?

Captain Colston: Yes, ma'am.

First, there are opportunities for reclama, so there are boards of correction for military records.

The second thing that we implemented was an across-the-board look at people who had medical boards stopped for one reason or another, say for disciplinary reasons. And we had a Physical Disability Board of Review actually look at those. And opposed to like a BCMR where maybe 5 percent of cases get recharacterized, that board was around 30 percent.

We also wrote special guidance for the boards of correction for military records, secondary to some Senator

Blumenthal's efforts, for Vietnam vets and other folks who may have had illnesses before we even had the capability to recognize this.

Really, the first good literature about PTSD and TBI and really good about post-concussive symptoms and mental health systems that were sustained well beyond having those two things together was an epidemiological study by Lisa Brenner in 2010 at the MIRECC in Denver, one of my VA colleagues.

So the science is still nascent, but we really need to protect folks.

I think that we have tried to get ahead of the problem in a lot of ways. So now before we administratively separate someone, we do an evaluation for PTSD and TBI.

When I was a resident at Walter Reed in 2000, we would administratively separate people from the emergency room. And in fact, we had about 4,000 administrative separations for mental health issues a year. We have reduced that to 300 now. So that was a round turn. That happened really quickly in the late 2000s.

Senator Gillibrand: Great. Related, many survivors of military sexual trauma suffer from PTSD as a result of that trauma. What is the military doing to diagnose and treat PTSD that results from military sexual trauma? Is their diagnosis and treatment different than the diagnosis and

treatment for PTSD caused by a blast injury or other combat activity where there might be a co-occurring brain injury?

Captain Colston: Absolutely. I think that Edna Foa's group at the University of Pennsylvania, I think CPT and prolonged exposures, those are both very good treatments for military sexual trauma.

I think one of the things that I have noticed as a psychiatrist is you can take a person who really did not have a lot of premorbid illness, who did not have adverse childhood experiences, they can be sexually assaulted, and they can just break apart. So as leaders, it is really incumbent upon us to set up a system where we are vigilant for those types of injuries.

The incidence of sexual harassment and abuse in this Nation is horrible, and in the cohort of patients that I treat, of course, it is much higher.

So we need to be really focused on access to care for that group, meeting patients where they are, and the ability of confidential care.

For instance, a servicemember can actually walk into a VA vet center and get treatment for military sexual trauma. But as a clinician who is actually writing things in the record, I also need to be sensitive to that patient's needs. I do not need to be writing details about what is going on, nor do I have to have a close contact with command. I need

to be focused on that patient's needs and making that patient better.

Senator Gillibrand: I appreciate that.

Can I ask a follow-up?

Senator Tillis: Sure.

Senator Gillibrand: So to Dr. Scholten and Dr. Cifu, please describe the VA programs that have been developed to diagnose and treat military sexual trauma-induced PTSD in veterans seeking treatment for TBI. And are we doing enough?

Dr. Scholten: Thank you for that question.

So VA has an extensive military sexual trauma program and implementation of screening at all VA medical centers. We screen every veteran accessing VA for care for military sexual trauma. Actually, the screening rate was 98.7 percent in fiscal year 2016.

Senator Gillibrand: Can you do it from the other end? If someone comes in for PTSD, do you check that it might be not a blast but actually trauma? Meaning, they do not come in for sexual trauma; they come in for PTSD.

Dr. Scholten: Exactly. Right. And that is a good point, because military sexual trauma is not a diagnosis. It is an experience. And so they are screened for the diagnosis as well as the experience, and then their individual treatment plan is based upon their symptomatology

and their presentation.

In addition, VA has a large research portfolio trying to better understand the impact of military sexual trauma and its effect on associated mental health conditions.

Dr. Cifu: And importantly, so if they come in, they get screened, for example, for TBI, they are also going to be screened for the PTSD diagnosis. And that PTSD diagnosis could be due to military sexual trauma.

The beauty of the integration of the VA system across every VA is that the team doesn't just treat TBI or PTSD from a blast or a depression. The team is set up to treat all the diagnoses within the same setting with the same core of providers.

That is a huge difference. Nobody wants to come back 3 days later or go to another setting.

Senator Gillibrand: Exactly.

Dr. Cifu: So we are very aware that each patient is unique, but we are doing it within the same team context, what used to be called a medical home. Primary care is involved, but the specialists are, too.

So each diagnosis is vitally important but military sexual trauma, it has a uniqueness to it. But that is also handled in the same setting, which we think is an advantage across the U.S.

Senator Gillibrand: Thank you very much.

Senator Tillis: Just one final question for Dr. Colston.

Dr. Colston, when you were describing your experience working near a reactor, the beauty of that is you knew where it was, and you had precise measurement devices to make sure that you were in a safe environment. Is there any work being done to, again, look at the MOS or the task?

Let's say that you are in artillery or you are in various conditions where -- again, the cumulative impact that we were talking about is something that I have not spent a lot of time studying, and I will -- but any way where we could reasonably predict that some people need to be tested or we have to provide research just based on the -- until we have helmets that can deflect the waves and do the sorts of things to minimize the injury, is there any research being done in DOD in that light?

Captain Colston: Yes, sir. In fact, I was speaking with my colleague, Dr. Bennett, who is in the audience, at the Office of Naval Research yesterday about a lot of the work that is being done around blast physics and attempt to ascertain what happens with any particular blast.

You shoot a .50 caliber, that is about a half PSI pressure wave. A breacher is seeing maybe 2 PSI. But a breacher may see 400 or 500 of those. And then, certainly, an IED can be something much higher than 10 or 15.

We are very worried about what we see downstream. Dr. Perl at the Uniformed Services University has seen almost a pathognomonic lesion associated with blast injury.

Now, there is a lot of crossover in between lesions that we see in the brain, but this particular lesion was at density junctions, in other words, right where you would deposit injury from a blast wave.

And a blast wave is not just running 25,000 feet a second through the brain. There is also a coup-contrecoup injury, where your brain is sloshing around in your skull, and, obviously, fragments.

So there is all kinds of work to do in the research realm that we are working on assiduously, and we need to do it fast, because, certainly, the next battles are out there.

Senator Tillis: I want to thank all of the panelists from the first and second panel for being here. I think this has been a very informative hearing, and it is one that we need to focus a lot of attention on. I think we have all highlighted our concern prospectively for men and women serving in uniform but also for the veterans.

So I thank you all for your testimony and your time here today.

We will hold the committee record open through the end of business tomorrow, so that you can submit any other information. We may also submit some questions for the

record, and other members will be allowed to do the same.

[The information referred to follows:]

[SUBCOMMITTEE INSERT]

Senator Tillis: Thank you all for being here today. Thank you for your service to our veterans and our men and women in uniform.

This committee is adjourned.

[Whereupon, at 11:23 a.m., the hearing was adjourned.]